CLAIMS

1. A water system comprising:

a free radical species source fluidly connectable to the water system;

an input apparatus disposed in the water system for providing an input signal corresponding to a water quality of the water system; and

a control system for receiving and analyzing the input signal and regulating the free radical species source to maintain any of a predetermined ORP, COD, TOC and chloramine level in the water system.

2. The water system of claim 1, further comprising a halogen source fluidly connected to the water system.

3. The water system of claim 1, wherein the predetermined ORP, COD, TOC or chloramine level is maintained at a level sufficient to sanitize the water system.

4. The water system of claim 1, wherein the free radical species source comprises an ultraviolet radiation emission source.

5. The water system of claim 4, wherein the ultraviolet radiation source has a power output of less than about 1 KW.

6. The water system of claim 1 wherein the free radical species source generates hydroxyl free radical species.

7. The water system of claim 1, wherein the chloramine level in the water system is less than about 2 ppm.

8. The water system of claim 7, wherein the chloramine level is less than about 1 ppm.

9. The water system of claim 1, wherein the TOC in the water system is less than about 2 ppm.

10. The water system of claim 9, wherein the TOC in the water system is less than about 1 ppm.

11. The water system of claim 1, wherein the ORP range in the water system is about 700 mV to about 850 mV.

12. The water system of claim 11, wherein the ORP range in the water system is about 750 mV +/- 1%.

13. The water system of claim 1, wherein the halogen species is at least one of trichloroisocyanuric acid, dichloroisocyanuric acid, sodium bromide, hydantoin-based bromine, gaseous chlorine, calcium hypochlorite, sodium, hypochlorite, and lithium hypochlorite.

14. The water system of claim 1, wherein the addition of the halogen species is regulated to about 0.1 ppm to about 10 ppm.

15. The water system of claim 1, further comprising a free radical precursor source fluidly connected to an ultraviolet radiation source disposed to irradiate the liquid.

16. The water system of claim 15, wherein the free radical precursor is constructed and arranged to provide at least one of hydrogen peroxide, ozone, oxygen, and a peroxygen compound.

17. A control system for maintaining a water quality of a water system comprising:

an input apparatus connected to the water system for transmitting an input signal corresponding to the water quality of the water system;

a microprocessor for receiving and analyzing the input signal according to a logic program code and generating a halogen output signal and a hydroxyl output signal;

a halogen species source configured to receive the halogen output signal and provide halogen species to the water system; and

a hydroxyl species source configured to receive the hydroxyl output signal and provide hydroxyl free radical species to the water system.

18. The control system of claim 17, wherein the hydroxyl species source comprises an ultraviolet radiation source.

19. The control system of claim 18, wherein the ultraviolet radiation source is fluidly connected to a substantially pure water source.

20. A method of maintaining water quality in a water system comprising:

irradiating a liquid substantially free of hydroxyl free radical scavengers with ultraviolet radiation from an ultraviolet radiation source to generate hydroxyl free radical species;

monitoring the water quality of the water system;

adding a halogen species to the water system;

adding the hydroxyl free radical species to the water system; and

controlling the addition of the hydroxyl free radical species to maintain a predetermined water quality.

21. The method of claim 20, wherein the liquid is substantially pure water.

22. The method of claim 20, further comprising the step of controlling the addition of the halogen species.

23. The method of claim 20, further comprising the step of maintaining a halogen species concentration in the aquatic system of about 0.2 ppm to about 10 ppm.

24. The method of claim 20, wherein the halogen species is at least one of trichloroisocyanuric acid, dichloroisocyanuric acid, sodium bromide, hydantoin-based

bromine, gaseous chlorine, calcium hypochlorite, sodium, hypochlorite, and lithium hypochlorite.

25. The method of claim 20, wherein the predetermined water quality corresponds to an ORP range of about 700 mV to about 850 mV.

26. The method of claim 20, wherein the predetermined water quality corresponds to a chloramine concentration of less than about 1 ppm.

27. The method of claim 20, wherein the predetermined water quality corresponds to a TOC of less than about 1 ppm.

28. The method of claim 20, further comprising the step of adding a hydroxyl free radical precursor.

29. The method of claim 28, wherein the hydroxyl free radical precursor is hydrogen peroxide.

30. A method of operating a water system comprising:

measuring a water quality of water in the water system;

comparing the water quality to a desired water quality level; and

adding a hydroxyl free radical species to the water in an amount sufficient to bring the water quality to within the desired water quality level.

31. The method of claim 30, wherein adding the hydroxyl free radical species maintains an ORP of the body of water at about 700 mV to about 900 mV.

32. The method of claim 31, wherein the ORP is maintained at about 780 mV +/- 1%.

33. The method of claim 30, further comprising the step of adding a halogen species to the water system.

34. The method of claim 33, wherein the halogen species is added to maintain a halogen species concentration of about 0.2 ppm to about 10 ppm.

35. The method of claim 34, wherein the halogen species is added to maintain the halogen species concentration of about 1.5 ppm to about 2 ppm.

36. The method of claim 33, wherein the halogen species is at least one of trichloroisocyanuric acid, dichloroisocyanuric acid, sodium bromide, hydantoin-based bromine, gaseous chlorine, calcium hypochlorite, sodium, hypochlorite, and lithium hypochlorite.

37. A water system comprising:

means for providing free radical species to water in the water system; and

means for regulating an amount of free radical species provided to the water to maintain a desirable water quality of water in the water system.